1477649 COMPLETE SPECIFICATION
4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1

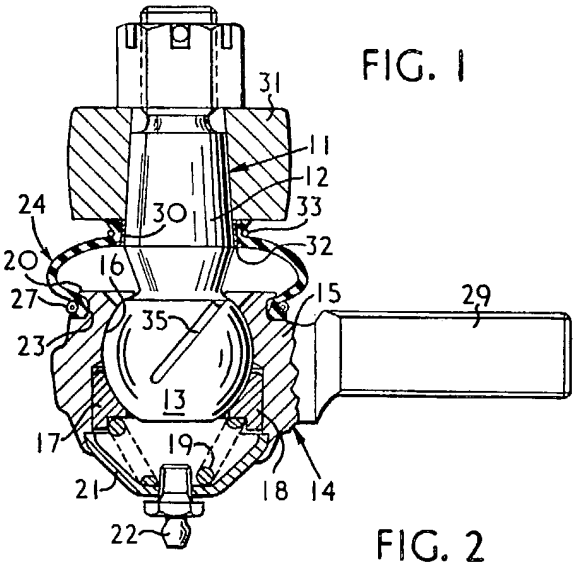

FIG. 2

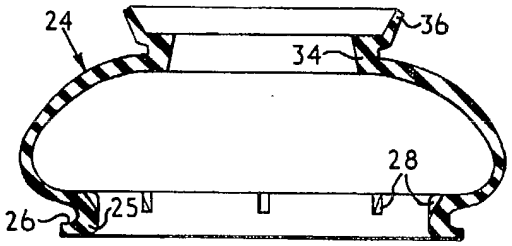

FIG. 3

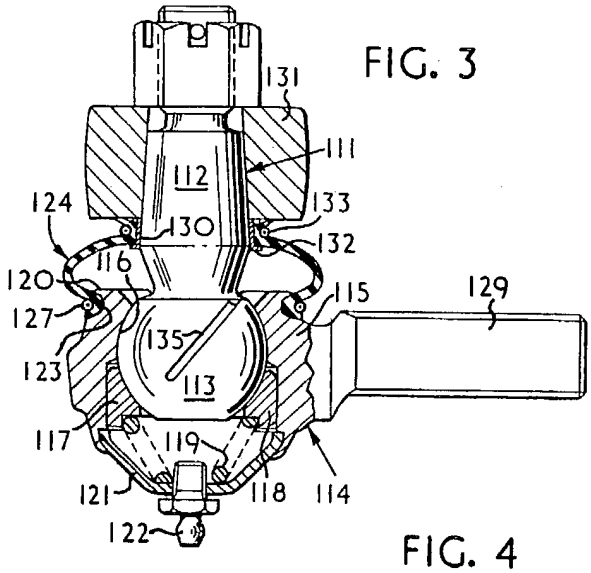
131
111
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FIG. 4

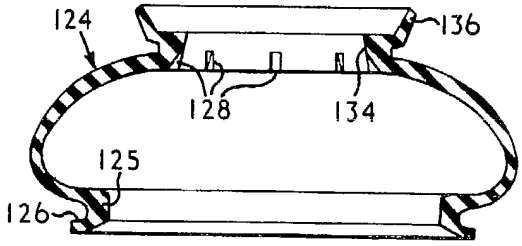

124
136
128
134
125
126

FIG. 5

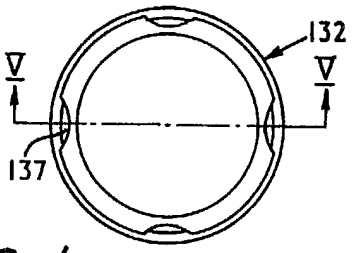


FIG. 6

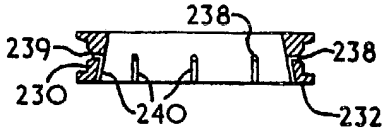
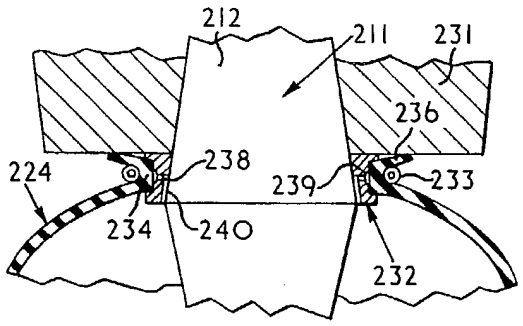


FIG. 8


212
211
231
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224
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240
232

FIG. 7

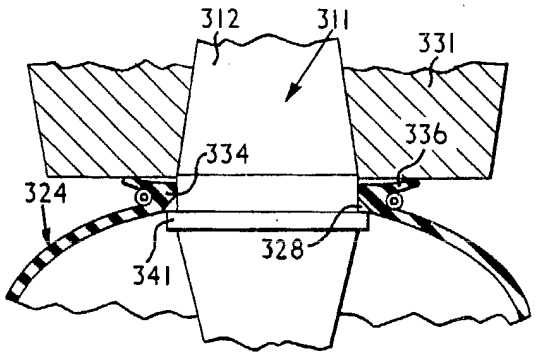
312
311
331
336
334
324
328
341

FIG. 9

PATENT SPECIFICATION

(11) **1 477 649**

1 477 649

(21) Application No. 51663/74 (22) Filed 28 Nov. 1974
(23) Complete Specification filed 18 Nov. 1975
(44) Complete Specification published 22 June 1977
(51) INT CL² F16J 15/52
(52) Index at acceptance
F2B 13C2E1C 13C2F4 13C3 13CX9

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(19)

(54) IMPROVEMENTS IN OR RELATING TO PIN-AND-SOCKET JOINTS

(71) We, AUTOMOTIVE PRODUCTS LIMITED, a British Company of Tachbrook Road, Leamington Spa, Warwickshire, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to pin and socket joints of the kind in which a pin is mounted in a socket member so as to be movable therein in both rotation and tilting or in rotation or tilting only and a gaiter of flexible material (commonly called a boot) seals an aperture in the socket member through which the pin extends. Such joints are commonly used in the suspension and steering linkages of motor vehicles and the boot has the dual functions of retaining grease lubricant within the joint and preventing contamination from road dirt and water.

Although pin and socket joints of this kind are greased on assembly, it is often thought desirable to add more grease on fitting to the vehicle or to replenish the grease at intervals during the service life of the joint, a grease nipple being provided for the purpose. This can cause problems if too much grease is injected or if the grease is injected too fast because the boot is liable to jump out of a groove where it engages the socket member or the pin or can even burst under pressure.

It is an object of the invention to provide a pin and socket joint which has a boot which will permit greasing without the problems referred to.

Accordingly, the invention provides a pin and socket joint of the kind described wherein one of the pin and the socket member has a flange extending into the interior of the boot to define a wall of a groove in which an adjacent end of the boot is engaged and circumferentially spaced passages provide a direct communication from the interior of the boot to the base of the groove, the passages allowing air and excess grease to escape by temporarily lifting the boot away from the base of the groove when grease is injected into the joint.

Several embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, of which:—

Fig. 1 is a cross-section through a first embodiment of a pin and socket joint according to the invention;

Fig. 2 is an enlarged cross-section of the boot incorporated in the pin and socket joint shown in Fig. 1;

Fig. 3 is a cross-section through a second embodiment of a pin and socket joint according to the invention;

Fig. 4 is an enlarged cross-section of the boot incorporated in the pin and socket joint shown in Fig. 3;

Fig. 5 is an enlarged cross-section of a component of the pin and socket joint shown in Fig. 3;

Fig. 6 is a plan view of the component shown in Fig. 5;

Fig. 7 is an enlarged scrap section of a pin and socket joint which is similar to that shown in Fig. 3 but which incorporates a third embodiment of the invention;

Fig. 8 is an enlarged cross-section of a component of the pin and socket joint shown in Fig. 7;

Fig. 9 is an enlarged scrap section of a pin and socket joint which is similar to that shown in Fig. 3 but which incorporates a fourth embodiment of the invention.

The pin and socket joint shown in Fig. 1 is of the kind usually referred to as a ball and socket joint, or simply a ball joint. The ball joint comprises a ball pin 11 having a tapered stem portion 12 and a part spherical ball head 13 for movement in both rotation and tilting in a socket member 14. The socket member 14 comprises a socket housing 15 machined to form a part spherical bearing surface 16 and to accommodate two bearing blocks 17, 18. The

bearing blocks 17, 18 are maintained in contact with the ball head 13 by a conical coil spring 19 which abuts a closure plate 21. The closure plate 21 is retained in the socket housing 15 by peening and is provided with a grease nipple 22.

The external surface of the socket housing 15 is roughly cylindrical and at the end where the ball pin 11 protrudes is machined to provide a radially extending flange 20 defining a wall of a groove 23. A boot 24 comprising a gaiter of polyurethane synthetic rubber material seals the aperture through which the ball pin 11 extends and has its adjacent end engaged in the groove 23. The flange 20 extends into the interior of the boot 24. The boot 24 has a beaded rim 25 where it engages the groove 23, the beaded rim 25 having an external groove 25 fitted with a clamping band 27 of the type comprising a coil spring formed into a garter. The boot has eight circumferentially spaced notches 28 (Fig. 2) in that surface portion which engages the flange 20, the notches 28 extending into a part only of that surface portion which engages the base of the groove 23. Each notch 28 is of rectangular cross-section and varies in depth such that its base forms a straight diagonal which, when extended, intersects the axis of the socket groove 23.

The socket housing 15 has a screwed shank 29 for attaching to a motor vehicle steering component, e.g. a track rod. The tapered stem portion 12 of the ball pin 11 is for fitment into a correspondingly tapered hole of a steering arm 31. A flanged bush 32 of acetal resin plastics material is fitted to the tapered stem portion 12 at the end nearest the ball head 13, the bore of the bush 32 being dimensioned so that when the steering arm 31 is in place there is an interference fit of the bush 32 on the tapered stem portion and the bush 32 is biassed into contact with the steering arm 31. The other end of the boot 24 to that which engages the groove 23 in the socket member has a bead 34 which fits into a groove 30 between the flanges of the bush 32 and is retained by a wire ring 33. A lip 36 on the boot 24 provides a seal with the steering arm 31. When the joint is charged with grease through the nipple 22, the grease enters the space sealed by the closure plate 21, flows past a clearance between the two bearing blocks 17, 18 and through a groove 35 in the ball head 13 into the interior of the boot 24. The notches 28 act as passages which allow air and excess grease to temporarily lift the bead 25 slightly away from the base of the groove 23 and to escape past the lip 36.

The joint shown in Fig. 3 is similar in many respects to that shown in Fig. 1 and the following description will concentrate on the differences. Where appropriate identical references are used with the addition of 100.

The boot 124, shown in detail in fig. 4, has a plain bead 125, tapered on its outer edge where it engages a correspondingly tapered wall of the groove 123. The taper provides a good axial interference fit of the bead 125 in the groove 123 to prevent the boot turning on the socket member 114 when in use.

The bush 132 is similar to the bush 32 but has the upper flange cut away at four places to form a scolloped edge 137 (Figs. 5 and 6). The bead 134 of the boot 124 has eight circumferentially spaced notches 128 in the surface portion which engages the lower flange of the bush 132, the notches extending into a part only of that surface portion which engages the base of the groove 130. Each notch 128 is similar to the notches 28, being of rectangular cross-section and varying in depth so that its base form a straight diagonal which, when extended, intersects the axis of the groove 130. When the joint is charged with grease through the nipple 122, the notches 128 act as passages which allow air and excess grease to escape from the interior of the boot by temporarily lifting the boot away from the base of the groove 130. The air and excess grease continue to escape through the cut-away portions formed by the scolloped edge 137 of the upper flange in the bush 132 and out between the lip 136 and the steering arm 131. To allow the boot to expand slightly a garter spring 133, similar to garter 27, is used.

The third embodiment of the invention, Fig. 7, represents a modification to the joint shown in Fig. 3 and where appropriate the same references as Fig. 3 will be used with the addition of 100.

The boot 224 has a plain bead 234 where it fits between the flanges of a modified bush 232 (shown in section in Fig. 8). This bush 232 has eight grooves 240 in its bore surface which extend from the lower flange in the direction of the bore to connect with eight radially extending holes 238 connecting the bore with the base of the groove 230 formed between the upper and lower flanges. Both flanges are plain, the upper flange being radially inclined on its inner wall surface. The base of the groove 230 itself has a shallow groove 239 where the holes 238 break out so that there is a slight clearance between the bush 232 and the boot bead 234 over a central band in the base of groove 230. A garter spring 233 holds the bead 234 in the bush 232.

When the joint is charged with grease the grooves 240 and radial holes 238 act as passages to allow escaping air and excess grease to temporarily lift the boot away from the base of the groove 230 and to escape past the boot lip 236. The shallow

groove 239 is designed to spread grease pressure over a large area of the boot bead 234 to reduce the pressure at which the bead 234 starts to lift. The inclined inner wall surface of the upper flange of the bush 232 gives a clearance between the bead 234 and itself when the air and grease escapes whilst providing sealing against ingress of dirt or moisture during normal use of the joint.

The fourth embodiment of the invention, Fig. 9, represents another modification to the joint shown in Fig. 3 and where appropriate the same references as Fig. 3 will be used with the addition of 200.

In this embodiment the boot 324 is substantially identical to the boot 124. There is no bush corresponding to bush 132 but instead a flange 341, corresponding to the lower flange of bush 132, is integral with the ball pin 311, to define one wall of a groove in which the bead 334 is engaged. The flange 341 is positioned so that when the steering arm 331 is in place the bead 334 is biassed away from the steering arm 331 by the lip 336 and into abutment with the flange 341 to leave a clearance between the bead 334 and the steering arm 331 which then acts as the other wall of the groove.

When the joint is charged with grease the notches 328 act as passages to allow escaping air and excess grease to temporarily lift the boot away from the base of the groove defined by the flange 341 and the ball pin 311. Grease then escapes through the clearance between the bead 334 and the steering arm 331 and out past the lip 336.

In each of the joints described above air and excess grease can escape during regreasing without excess pressure being developed, such excess pressure in prior art designs often either bursting the boot or leaving the boot partially or completely displaced from its groove. The boots provide effective seals against ingress of water and dirt and retain grease inside the joints in service because the escape passages are normally blocked and are only opened during the greasing operation.

WHAT WE CLAIM IS:—

1. A pin and socket joint of the kind in which a pin is mounted in a socket member so as to be movable therein in both rotation and tilting or in rotation or tilting only and having a boot which seals an aperture in the socket member through which the pin extends, wherein one of the pin and the socket member has a flange extending into the interior of the boot to define a wall of a groove in which an adjacent end of the boot is engaged and circumferentially spaced passages provide a direct communication from the interior of the boot to the base of the groove, the passages allowing air and excess grease to escape by temporarily lifting the boot away from the base of the groove when grease is injected into the joint.

2. A pin and socket joint according to Claim 1 wherein the flange and groove are provided by a bush fitted to the stem of the pin.

3. A pin and socket joint according to Claim 2 wherein the bush has a second flange to define another wall of the groove.

4. A pin and socket joint according to Claim 3 wherein the second flange is cut away to provide a further passage for escaping grease or air.

5. A pin and socket joint according to Claim 3 wherein the second flange has its inner wall radially inclined to provide a clearance between the boot and the second flange when the boot is lifted from the base of the groove by escaping grease or air.

6. A pin and socket joint according to any preceding Claim wherein the passages comprise notches in the surface portion which engages the flange, the notches extending into a part only of that surface portion of the boot which engages the base of the groove.

7. A pin and socket joint according to Claim 6 wherein each notch is of rectangular cross-section.

8. A pin and socket joint according to Claim 6 or Claim 7 wherein the depth of each notch varies such that its base forms a diagonal which, when extended, intersects the axis of the groove.

9. A pin and socket joint according to any one of Claims 2, 3, 4 or 5, wherein the passages are in the bush.

10. A pin and socket joint according to Claim 9 wherein the passages comprise grooves in the bore of the bush and radial holes extending between the base of the groove and the bore.

11. A pin and socket joint according to any preceding claim wherein a clearance is provided between the groove and the boot over a central band portion of the groove, the passages opening into the clearance.

12. A pin and socket joint according to any preceding claim wherein the boot has a beaded rim where it engages the groove.

13. A pin and socket joint according to Claim 12 wherein the beaded rim has an external groove into which is fitted a garter.

14. A pin and socket joint substantially as described herein with reference to Fig. 1 and Fig. 2, or Fig. 3, Fig. 4, Fig. 5 and Fig. 6 or Fig. 7 and Fig. 8, or Fig. 9 of the accompanying drawings.

15. A boot for a pin and socket joint as claimed in any one of Claims 6, 7 and 8, or

Claims 12 or 13 when each is appended to any one of Claims 6, 7 and 8.

16. A boot for a pin and socket joint substantially as described herein with reference to Fig. 1 and Fig. 2 or Fig. 3 and Fig. 4 of the accompanying drawings.

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Agent for the Applicants.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1977.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.